CLAIMS

1. A microporous material comprising organic macromolecules comprised of first generally planar species connected by rigid linkers having a point of contortion such that two adjacent first planar species connected by the linker are held in non-coplanar orientation, subject to the proviso that the first species are other than porphyrinic macrocycles.

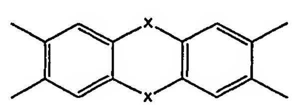
2. A microporous material comprising organic macromolecules comprised of first generally planar species connected by rigid linkers predominantly to a maximum of two other said first species, said rigid linkers having a point of contortion such that two adjacent first planar species connected by the linker are held in non-coplanar orientation.

3. A microporous material according to claim 1 or 2, wherein the point of contortion is a spiro group, a bridged ring moiety or a sterically congested single covalent bond around which there is restricted rotation.

4. A microporous material according to claim 1, 2 or 3, wherein the point of contortion is provided by a substituted or unsubstituted spiro-indane, bicyclo-octane, biphenyl or binaphthyl moiety.

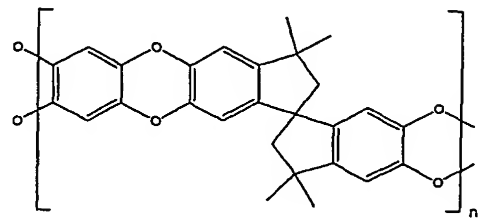
5. A microporous material according to any one of claims 1 to 4, wherein each of the first planar species comprises at least one aromatic ring.

6. A microporous material according to any one of claims 1 to 5, wherein each of the first planar species comprises a substituted or unsubstituted moiety of the formula:



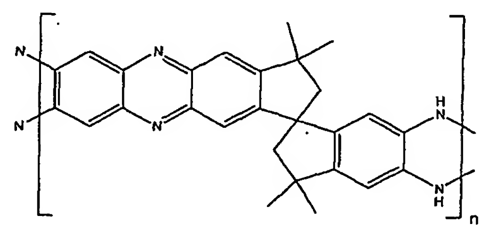
where X is O, S or NH.

7. A microporous material according to any one of claims 1 to 5, wherein the material comprises repeating units of formula:



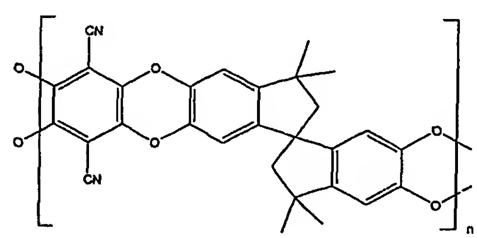
which may be substituted or unsubstituted.

8. A microporous material according to any one of claims 1 to 5, wherein the material comprises repeating units of formula:



which may be substituted or unsubstituted.

9. A microporous material according to any one of claims 1 to 5, wherein the material comprises repeating units of formula:



10. A microporous material according to claim 7, 8 or 9, wherein the organic macromolecules are comprised of at least 70 % by mole of the repeating unit.

11. A microporous material according to claim 7, 8 or 9, wherein the organic macromolecules are comprised of at least 80 % by mole of the repeating unit.

12. A microporous material according to claim 7, 8 or 9, wherein the organic macromolecules are comprised of at least 90 % by mole of the repeating unit.

13. A microporous material according to any preceding claim, wherein the material has a surface area of at least 300 m^2 g^{-1}.

14. A microporous material according to any preceding claim, wherein the material has a surface area of at least 500 m^2 g^{-1}.

15. A microporous material according to any preceding claim, wherein the material has a surface area in the range 600 to 900 m^2 g^{-1}.

16. A microporous material according to any preceding claim, wherein the material has a surface area in the range 700 to 1500 m^2 g^{-1}.

17. A microporous material according to any preceding claim, wherein the material has an average pore diameter of less than 100 nm.

18. A microporous material according to any preceding claim, wherein the material has an average pore diameter in the range 0.3 to 20 nm.

19. A microporous material according to any preceding claim, wherein the material has a number average mass in the range 1 x 10^3 to 1000 x 10^3 amu compared to polystyrene standards.

20. A microporous material according to any preceding claim, wherein the material has a number average mass in the range 15×10^3 to 500×10^3 amu compared to polystyrene standards.

21. A microporous material according to any preceding claim, wherein the material has a number average mass of approximately 20×10^3 to 200×10^3 amu compared to polystyrene standards.

22. A microporous material according to one of claims 1 to 19, wherein the material has a number average mass in the range 10 to 100×10^3 amu compared to polystyrene standards.

23. A method for producing the microporous material of any preceding claim comprising reacting a first monomer unit having a point of contortion with a pair of second generally planar monomer units.

24. A membrane comprising a microporous material according to any one of claims 1 to 22.

25. A membrane according to claim 24, wherein the membrane has a thickness which is less than or equal to 2 mm.

26. A membrane according to claim 24 or 25, wherein the membrane has a thickness which is less than or equal to 1 mm.

27. A membrane according to claim 24, 25 or 26, wherein the membrane has a thickness which is in the range 1 to 500 μm.

28. A membrane according to any one of claims 24 to 27, wherein the membrane has a thickness which is in the range 50 to 500 μm.

29. A membrane according to any one of claims 24 to 28, wherein the membrane has a thickness which is in the range 150 to 350 μm.

30. A membrane according to any one of claims 24 to 27, wherein the membrane has a thickness which is in the range 10 to 100 μm.

31. A membrane according to any one of claims 24 to 30, wherein the membrane includes an additional entity selected from a catalyst species, an organometallic species, an inorganic species, at least one type of metal ion; and at least one type of metal particle.

32. A membrane according to claim 31, incorporating an inorganic species which is a zeolite or a metal-containing organic catalyst such as a phthalocyanine or porphyrin.

33. A membrane according to any one of claims 24 to 32, wherein the membrane is of a form selected from the group consisting of: a pressed powder; a collection of fibres; a compressed pellet; a composite comprised a plurality of individual membrane layers; a free standing film; and a supported film.

34. A method for producing a free standing membrane in accordance with any one of claims 24 to 33, the method comprising the steps of: i) casting a solution of the microporous material of which the membrane is comprised; and ii) evaporating the solvent to produce the membrane.

35. A method for producing a supported membrane in accordance with any one of claims 24 to 33, the method comprising the steps of: i) casting a solution of the microporous material of which the membrane is comprised onto a suitable support; and ii) evaporating the solvent to produce the membrane.

36. A method for producing a supported membrane in accordance with claim 35, wherein the support is a macroporous inorganic or polymeric support.

37. A method in accordance with claim 34, 35 or 36, wherein the membrane produced is cross-linked using a suitable cross-linking agent.

38. A method in accordance with claim 37, wherein said cross-linking agent is palladium dichloride.

39. A method for separating a first species from a mixture of said first species and a second species, the method comprising the steps of: i) applying the mixture to one side of a membrane in accordance with any one of claims 24 to 33; ii) causing the first species to pass through the membrane; and iii) collecting the first species from an opposite side of the membrane.

40. A method in accordance with claim 39, wherein the mixture of the first and second species is in the gas or vapour phase.

41. A method in accordance with claim 39, wherein the mixture of the first and second species is in the liquid phase.

42. A method for enriching a first species in a first mixture of said first species and a second species, the method comprising the steps of: i) applying the first mixture to one side of a membrane in accordance with any one of claims 24 to 33; ii) causing the first mixture to pass through the membrane; and iii) collecting a second mixture of the first and second species, which is enriched in respect of the first species compared to the first mixture, from an opposite side of the membrane.

43. A method in accordance with claim 42, wherein the first mixture of the first and second species is in the gas or vapour phase.

44. A method in accordance with claim 42, wherein the first mixture of the first and second species is in the liquid phase.

45. A method in accordance with any one of claims 39 to 44, wherein at least one of the first and second species is an organic compound.

46. A method in accordance with any one of claims 39 to 45, wherein the first species is an organic compound and the second species is water.

47. A method in accordance with claim 45 or 46, wherein said organic compound is an alcohol or phenol.

48. A method in accordance with claim 45 or 46, wherein said organic compound is a halogenated hydrocarbon compound.

49. A method in accordance with any one of claims 39 to 44, wherein the first and second species are organic compounds and the first species is an isomer of the second species.

50. A method in accordance with claim 49, wherein at least one of said organic compounds is an alcohol.

51. A method in accordance with claim 49, wherein said organic compounds are halogenated hydrocarbon compounds.

52. A method in accordance with any one of claims 39 to 44, wherein at least one of the first and second species is a metal-containing compound.

53. A catalyst system comprising a catalytic species and a microporous material according to any one of claims 1 to 22.

54. A catalyst system according to claim 53, wherein the catalytic species is selected from the group consisting of: an acidic site; a basic site; a metal; and a metal salt.

55. A tissue support comprising a microporous material according to any one of claims 1 to 22.

56. A molecular sensor comprising a microporous material according to any one of claims 1 to 22.

57. An opto-electronic material comprising a microporous material according to any one of claims 1 to 22.

58. An opto-electronic material according to claim 57, wherein said material comprises an organic or inorganic electrically conducting material.